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SUBJECT: Broad Trends in Chinese Air Force and Missile Modernization

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## **Testimony before the U.S. – China Economic & Security Review Commission**

**January 30, 2014**

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**Technical Director for Force Modernization & Employment  
National Air & Space Intelligence Center**

### ***Broad Trends in Chinese Air Force and Missile Modernization***

**How would you characterize PLA Air Force modernization over the past five years? Has it accelerated during this time?**

PLA Air Force (PLAAF) modernization is progressing at a steady pace. While, we would not characterize the modernization as accelerated, the totality of PLAAF modernization is significant. The goal of PLAAF modernization is to improve capability to conduct offensive and defensive operations such as strike, air and missile defense, power projection, and early warning and reconnaissance. The key areas of emphasis include increased introduction of 4<sup>th</sup> generation multirole aircraft and the new H-6K bomber to increase PLAAF strike capabilities, as well as developing 5<sup>th</sup> generation fighters. To meet reconnaissance and early warning goals the PLAAF has fielded several Airborne Early Warning (AEW), Electronic Warfare, and command-and-control systems, such as the KJ2000 MAINRING and have fielded several Unmanned Air Vehicles (UAVs). To address their power projection deficiency, they have purchased a limited number of used IL-76 from Russian and are developing the Y20 heavy lift transport aircraft, and the Y9 medium-lift transport.

We should not take a “symmetric” view of PLAAF modernization in which we directly compare their developments to ours. We believe the Chinese are not trying to match the U.S. system vs. system, but are pursuing more of a system-of-systems approach that exploits what they perceive to be adversary weaknesses or exploitable vulnerabilities.

**How would you characterize PLA ballistic and cruise missile modernization over the past five years? Has it accelerated during this time?**

Similarly, PLA ballistic and cruise missile development is progressing at a steady pace. The PLA is expanding its conventional medium range ballistic missiles (MRBMs) to increase the range at which it can conduct precision strikes against land targets and naval ships (including aircraft carriers) operating far from China’s shores out to the first island chain. The PLA is developing conventional intermediate-range ballistic missiles (IRBM) at a steady pace, to increase its capability for near-precision strike out to the second island chain.

The PLA also continues to field air- and ground-launched land attack cruise missiles (LACMs) for stand-off, precision strikes at a steady pace. Air-launched cruise missiles include the YJ-63, KD-88, and the CJ-20. In the sense that China is developing a large number of new precision guided weapons, whereas 10 year ago they had very few, there has been an acceleration in modernization. New precision guided munitions and conventional missiles continue to emerge and will continue for the foreseeable future as Chinese investment in these technologies remains high. Nevertheless, the pace of development of individual systems has not accelerated.

### ***Strategy and employment***

**How would China likely employ the PLA Air Force in various Taiwan contingencies and in contingencies in the South China Sea?**

We'll answer this question in terms of three possible scenarios:

### 1. Taiwan

PLA operational literature describes several campaigns the Chinese might execute against Taiwan. The chosen military campaign will dictate PLAAF employment concepts, although many of the missions are not particular to any single campaign. The two large-scale Taiwan campaigns most often mentioned in PLA writings are blockade or island invasion. For a joint blockade of Taiwan, the PLAAF would be tasked with strikes against Taiwan defenses (described by the Chinese as the “counter-blockade system” and this includes Taiwan airfields, ground-based air defenses, coastal defense cruise missiles, and C4ISR facilities), as well as missions to enforce the blockade, such as enforcing a “no-fly zone.” The airstrikes would be preceded by missile attacks by the Second Artillery, as well as cyber attacks, special operations, and other unconventional warfare. Additionally, the PLAAF would support the attainment of PLA superiority in the information and maritime domains by attacking Taiwan command capabilities and providing some level of air cover for PLA Navy (PLAN) operations.

These blockade missions are in addition to the primary PLAAF mission of airspace defense of China. This mission is accomplished primarily using their Surface to Air Missiles (SAM) and fighter forces, but other PLA services contribute to the effort with electronic warfare, civil air defense, denial and deception, and other measures aimed at resisting precision strike operations. This core mission remains a strength within the PLAAF, especially in areas of strategic importance, such as Beijing, Shanghai, and along the Taiwan Strait.

An island invasion of Taiwan would include the missions described above, but also require the PLAAF to provide air cover to the amphibious units as they transit the strait and to strike Taiwan forces in support of PLA on-island operations. This on-island support would not likely be U.S.-style close air support (CAS), but rather pre-planned air interdiction attacks against Taiwan forces as needed. In addition, PLA airborne forces are subordinate to the PLAAF, so an island invasion would include airborne operations, probably designed to secure a Taiwan airfield or other important facility

### 2. South China Sea

A South China Sea conflict, particularly one at far reaches such as the Spratly Islands, will stress the ability of the PLAAF to project airpower in a sustained fashion. Limited aerial refueling capabilities, as well as a limited number of other “high demand-low density” assets such as Command, Control, Communications, Computers, Intelligence Surveillance and Reconnaissance (C4ISR) and support aircraft, greatly limits the PLAAF's capability to maintain presence over the expanse of the South China Sea. Depending on the contingency, the PLAAF would likely be called upon to conduct suppression strikes and to provide limited air cover for navy units. The strikes would likely include H-6 bombers employing cruise missiles against pre-planned targets. Fighter air cover will be possible for short periods during the most critical points of a campaign, but is not likely to be sustainable for long periods. As such, the PLA Navy could provide organic air defense and, as their aircraft carriers become operational in the out years, fighter cover.

### 3. Counter-Intervention

With regard to the Chinese military responses to U.S intervention in either of these cases (i.e. Taiwan or South China Sea conflicts), recent Chinese operational literature describes the need for a balanced approach that is tied to the main campaign objectives. This approach seeks to strike a balance between supporting the main campaign by deterring the “Powerful Enemy” and striking at them if necessary, with the need to avoid an expansion of the conflict. This newer literature reflects a departure from past PLA

writings that heavily focused on the need for pre-emptive operations against U.S. intervention, and we feel that this demonstrates, at least to a degree, a growing confidence within the PLA that they can more-readily withstand U.S. involvement (i.e., achieve their main campaign objectives) than in years past. This isn't to say the PRC might not still feel compelled to conduct preemptive actions against U.S. intervention, particularly in the cyber domain or other less "kinetic" ways; however, the PLA appears to be developing a more mature viewpoint on the broad application of military operations against the U.S. This means that, during a major campaign, the PLA will look to focus its operations primarily against Taiwan (or other adversary) and look to deter U.S. intervention or limit the effects of the intervention.

Should the PRC decide U.S. intervention is having, or is likely to have, a significant impact on the success of their campaign, the PLAAF and Second Artillery would be tasked with strikes against U.S. forces and facilities. Such attacks would employ significant numbers of available Chinese combat assets and would be well planned and rehearsed. It is likely that they would be accompanied by cyber attacks on U.S. military and other government networks. The speed, reach, and increasing technical sophistication of China's air and missile forces would make them crucial parts of such an operation. Chinese writings, although not specifically directed at the U.S., discuss the importance of attacks on logistics, supply depots, air bases, and ports by air, ballistic and/or cruise missiles, special forces, and other means. The use of these weapons against potential U.S. assets reinforces China's anti-access strategies. Chinese analysts note the importance of military on Okinawa and Guam, and these assets and their supporting infrastructure are likely high priority targets of the PLAAF and Second Artillery.

#### **Will equipping ballistic missiles with multiple independently targetable reentry vehicles (MIRVs) change China's missile strategy?**

Mobile missiles carrying MIRVs are intended to ensure the viability of China's strategic deterrence. MIRVs provide operational flexibility that a single warhead does not. Specifically, they enable more efficient targeting, allowing more targets to be hit with fewer missiles, more missiles to be employed per target, or a larger reserve of weapons held against contingency. China is likely to employ a blend of these three as MIRVs become available, simultaneously increasing their ability to engage desired targets while holding a greater number of weapons in reserve. We judge China won't pair MIRVs with conventional payloads, as they already have multiple conventional strike options, and the cost of development and deployment of this capability likely exceeds the benefits.

#### **What role do land attack cruise missiles (LACMs) have in China's missile strategy?**

Combining long stand-off distances with high accuracy make cruise missiles an excellent tool to reach targets difficult to engage with many other classes of weapons. Because there is an overlap in the kinds of targets China is likely to engage with either ballistic missiles or cruise missiles, LACMs provide key operational and planning flexibility. These weapons are likely to reduce the burden on ballistic missile forces, as well as creating somewhat safer strike opportunities for Chinese aircrew, allowing them to engage from much longer distances and/or from advantageous locations of their own choosing. This in turn will complicate their adversary's air and missile defense problem. Combining cruise missiles with ballistic missile attacks on the same target further complicates the defensive problem. Fundamentally, LACMs are yet another component of China's complex arsenal, and could be used as a flexible tool for engaging a range of targets.

#### ***Weapons***

**What capabilities does the PLA Air Force have and what capabilities is it currently developing?  
How many aircraft does the PLA Air Force have and what aircraft is it currently developing?**

The PLA Air Force and PLA Navy have approximately 2,300 operational combat aircraft. An additional 1450 older fighters, bombers, and trainer aircraft are employed for training, research, and development. The two arms also possess 475 transports and 100 surveillance and reconnaissance aircraft.

In addition to the J-20 and advanced fighter concept fifth generation aircraft, four new versions of China's 4<sup>th</sup> generation fighters are under development. The Chinese are also modernizing their existing fleet of 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> generation aircraft. The Chinese have begun fielding the H-6K and have attack Unmanned Air Vehicles (UAVs), both fielded and in development. To achieve a modernized military, China has been developing a wide range of UAVs including long-range and low-observable systems that are capable of conducting reconnaissance and strike missions. As mentioned earlier, a number of transport aircraft are also under development. They are also developing multiple new trainers to replace aging 2<sup>nd</sup> generation fighters that are used in this role.

### **How far can these aircraft fly without refueling?**

An increasing number of Chinese aircraft are capable of operating over water at ranges from 300-500 nautical miles (nm) from the coast of China without refueling. The fighter offering the greatest range, and which can reach the first island chain, is the Flanker series of aircraft purchased from Russia. Chinese bombers such as the H-6K can range farther out from the mainland, threatening.

### **With what type of radar are they equipped?**

The PLAAF probably plans to integrate Active Electronically Scanned Array (AESA) technology on the fifth generation and on current fourth generation fighters providing instantaneous target updates, up to 10 times more processing power for greater detection range, large search volumes, an ability to stare at a target or electronically steer the radar beam, and track multiple targets simultaneously. These features combined provide faster target acquisition time and more accurate target position data. AESA also offers one practical way of achieving a low-observable capability. AESA radar air-to-ground modes are extremely effective at long range target detection and generate accuracies under 10 feet.

Advanced 4<sup>th</sup> generation fighters have passive electronically scanned array (ESA) radars, providing long-range radar detection and electronically scanned radar beams that enable the radar to track many targets. The end result is reduced pilot workload, automatic target acquisition, and highly accurate target position for air combat engagements. Air-to-ground modes with pinpoint accuracy for precision-guided weapon delivery are also available.

### **What is the range and capability of their missiles?**

China has a rapidly maturing capability to design and produce medium range launch-and-leave air-to-air missiles and has fielded the active-radar guided PL-12. China's next generation of missiles will reflect the country's growing technology base.

China will field a short-range air-to-air missile that utilizes an imaging infrared seeker and digital processing that enhances seeker lock-on range, expands the operational launch envelope, and better allows the air-to-air missiles (AAM) that may utilize an imaging infrared seeker and digital processing to enhance seeker lock on range. Short-range infrared air-to-air missiles will also be highly maneuverable; when combined with the use of helmet-mounted sights, pilots will be able to launch missiles against almost any target the pilot can visually spot. To cue a missile against a target, the pilot simply looks in the direction of the target (which may fall outside the field-of-view of the aircraft's on-board sensors), and presses a button to lock onto the target.

### **What is the electronic warfare capability of these aircraft?**

The PLAAF heavily emphasizes electronic warfare as a key component of air combat and is equipping a substantial number of their more modern aircraft with digital radio frequency memory (DRFM) jammers. DRFM jammers enable instantaneous “smart jamming” responses by potentially automatically selecting jamming waveforms to counter a specific threat. DRFM jammer employment could improve fighter aircraft survivability by disrupting or denying the opposing fighter’s radar from tracking.

### **How would you assess China’s ability to produce advanced platforms and equipment for the PLA Air Force? How dependent is China on foreign technology and designs in building military aircraft?**

China’s aviation industries have advanced and they have a solid base for producing modern 4<sup>th</sup> generation fighters and bombers. China’s aviation industry has invested in high-precision and technologically advanced manufacturing technologies. In addition, commercial joint ventures provide a ready conduit for raw materials and manufacturing technology. China’s latest tactic is the outright purchase of companies to ensure ready access to desired technologies. The largest impediment has been the lack of systems engineering and advance management techniques, although this is improving.

The lack of funding prior to 2000 combined with the lack of experienced personnel within China’s aircraft engine industry has forced a reliance on foreign sourcing for dependable, proven aircraft engines. The Chinese are now making huge investments into their aircraft engine industry..

### **What are the PLA’s ballistic and cruise missile capabilities and what ballistic and cruise missile capabilities is the PLA developing? How many ballistic missiles does the PLA have?**

The Second Artillery is expanding its conventional MRBM force and developing IRBMs to extend the targeting distance for conventional precision or near-precision strikes.

Short-Range Ballistic Missiles (< 1,000 km): The Second Artillery had more than 1,100 SRBMs at the end of 2012, a modest increase over the past year. This number reflects the delivery of additional missiles and the fielding of new systems. To improve the lethality of this force, the PLA is also introducing new SRBM variants with improved ranges, accuracies, and payloads.

Medium-Range Ballistic Missiles (1,000-3,000 km): The PLA is fielding conventional MRBMs to increase the range at which it can conduct precision strikes against land targets and naval ships (including aircraft carriers) operating from China’s shores out to the first island chain. The DF-21D is based on a variant of the DF-21 (CSS-5) medium-range ballistic missile (MRBM). has a range exceeding 1,500 km, and is armed with a maneuverable warhead.

Intermediate-Range Ballistic Missiles (3,000-5,000 km): The PLA is developing conventional intermediate-range ballistic missiles (IRBM), increasing its capability for near-precision strike out to the second island chain. The PLA Navy is also improving its over-the-horizon (OTH) targeting capability with sky wave and surface wave OTH radars, which can be used in conjunction with reconnaissance satellites to locate targets at great distances from China (thereby supporting long-range precision strikes, including employment of anti-ship ballistic missiles (ASBMs).

The Second Artillery continues to modernize its nuclear forces by enhancing its silo-based intercontinental ballistic missiles (ICBMs) and adding more survivable mobile delivery systems. In recent years, the road-mobile, solid-propellant CSS-10 Mod 1 and CSS-10 Mod 2 (DF-31 and DF-31A)

intercontinental-range ballistic missiles have entered service. The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach most locations within the continental U.S.

**Which of the PLA's missiles can carry nuclear warheads?**

China currently relies on its CSS-2 IRBM and CSS-5 Mod 1 and Mod 2 MRBMs for regional nuclear deterrence. The CSS-3, CSS-4, and CSS-10 Mod 1/Mod 2 ICBMs are utilized as a strategic nuclear deterrent force.

**Which of the PLA's ballistic missiles is likely to be equipped with MIRVs? How many warheads will each missile likely carry?**

No conclusive information is available at this time.

**What is the range of the PLA's LACMs?**

The PLA has ground- and air-launched LACMs that can strike targets within the first island chain. Some bomber-launched LACMs can strike targets in the second island chain.

**How is the PLA improving the mobility of its ballistic missiles?**

China is improving the mobility of its ballistic missile systems by developing more survivable, road-mobile delivery systems. However, China continues to maintain a limited number of silo-based nuclear ICBMs.

**How is the PLA upgrading its missile systems? Do these qualitative upgrades rely on imported technologies?**

China is working on a range of technologies that could be used to counter ballistic missile defense systems, including maneuverable reentry vehicles (MaRVs), MIRVs, decoys, chaff, jamming, thermal shielding, and anti-satellite (ASAT) weapons. China's official media also cite numerous Second Artillery training exercises featuring maneuver, camouflage, and launch operations under simulated combat conditions, which are intended to increase survivability. Together with the increased mobility and survivability of the new generation of missiles, these technologies and training enhancements strengthen China's nuclear force and enhance its strategic strike capabilities. Further increases in the number of mobile ICBMs and the beginning of Ballistic Missile Submarine (SSBN) deterrence patrols could enable the PLA to implement more sophisticated command-and-control systems and processes that safeguard the integrity of nuclear release authority for a larger, more dispersed force. I do not have additional information available regarding upgrades via imported technologies.

***Organization***

**Where are the PLA Air Force's aircraft based?**

PLA Air Force (PLAAF) aircraft are deployed throughout the entire country, while the PLA Navy Air Force's (PLANAF) assets are stationed principally along the eastern and southern coasts. Combined, the two arms have over 2,300 combat aircraft, of which over 500 are modern or modernized. Aircraft are deployed asymmetrically, relative to China's threat and risk calculus, with particularly heavy concentrations amassed around Beijing, Shanghai, in the northeast, and along the southeastern coast. More than 500 combat aircraft operate from permanent bases which afford them the ability to conduct operations in and around Taiwan without aerial refueling, and hundreds of additional aircraft could be



deployed using China's ample military, civil, and reserve airfield network. To support large-scale deployments, China has worked hard to refine its civil-military mobilization support system and infrastructure: there are more than 50 airfields available to support a Taiwan contingency, for example.

**Which PLA Air Force units and aircraft are responsible for patrolling and monitoring the air defense identification zone that China declared in November 2013?**

China is not likely to maintain a constant aerial presence with either fighters or support aircraft. Instead, they will use their generally excellent and dense ground-based radar coverage to maintain awareness throughout the air defense identification zone (ADIZ), with command posts directing aircraft to respond from ground alerts as necessary. Additionally, Chinese maritime assets of various types are likely to be a near-constant presence in and around the ADIZ.

Active monitoring and management of the ADIZ requires shared efforts among coastal units, regional command posts particularly in the Nanjing Military Region, and command elements in Beijing. China has already monitored tens of thousands of flights through the ADIZ, including many it has identified as foreign warplanes, and has on many occasions sent its own military aircraft into the ADIZ in response. Ultimately, the Ministry of National Defense is responsible for ADIZ enforcement, which effectively places a very broad range of assets on the table.

We believe it likely that a mix of PLAAF and PLANAF units, deployed along or near the coast, are tasked with operations in the ADIZ, and have fighter aircraft like FLANKER and FIREBIRD at requisite steady-state levels of alert to support "emergency identification" missions. The PLAAF and PLANAF are both quite capable of scrambling fighter aircraft quickly. These forces are not limited to fighter-interceptor aircraft though, and will be augmented as necessary by special support aircraft such as airborne warning and control like the KJ-2000, as well as specialized reconnaissance aircraft. However, China's possible plans do not affect our basic policy of rejection of the ADIZ.

**Where are the PLA's ballistic missiles deployed?**

The majority of China's short-range ballistic missiles are deployed opposite Taiwan. Smaller contingents of both conventional and nuclear missile units are dispersed throughout China in order to deter enemy attack and offer protection to potentially volatile, vulnerable borders, particularly with India and North Korea. However, many of these units are mobile, and could be moved with very little warning.

**What kind of additional missile units is the Second Artillery Corps forming? What role are these new units likely to play in China's missile strategy?**

The Second Artillery continues to modernize its nuclear forces by enhancing its silo-based ICBMs, while simultaneously adding more survivable mobile delivery systems. In recent years, China's first road-mobile ICBMs have entered service, and a MIRV-capable road-mobile system may enter development in the near future. In addition, the PLA is fielding conventional MRBMs to increase the range at which it can conduct precision strikes against land and maritime targets (to include aircraft carriers) operating far from China's shores. Finally, China is developing conventional IRBMs, increasing its capacity for long range near-precision strike. Thanks to these developments, China's emerging missile strategy will be marked by increased shooter survivability, enhanced operational flexibility, and significantly greater reach and precision.

**Personnel, training, and joint operations**

## **What are the strengths and weaknesses of the training of personnel and of exercises conducted by the PLA Air Force and the Second Artillery Corps?**

The PLAAF and Second Artillery continue to be forces in a period of great transition, and they have made great strides over the past decade in increasing their survivability and lethality. In addition to the modernization efforts described above, these services have invested in operationalizing their increasing capabilities and professionalizing their personnel. A major thrust of this advancement has been in the area of improved training, and the PLA writ-large has worked to make training as realistic as possible to ensure their personnel are prepared for actual combat. Lack of recent actual combat experience is certainly a significant limitation in preparing the Chinese for the “fog of war.” Along with these great strides remain continuing challenges.

### **PLAAF**

The PLAAF has worked diligently at improving their aircrews and we judge they are professional and well-trained. One strength of PLAAF training includes the number and scope of their exercises, and recent years have seen the PLAAF executing increasingly large and complex training events. For example, the annual RED SWORD exercises feature multi-day, large-scale events that include all branches of the PLAAF in opposing force scenarios. These events are undoubtedly improving PLAAF combined arms capabilities and better preparing them for combat. Additionally, PLAAF training is characterized by a significant focus on information superiority, particularly in the realms of electronic attack and protection. As a result, electronic warfare (what Chinese term “complex electromagnetic conditions”) and other elements of information warfare are prominent in practically all PLAAF training.

While the PLAAF has made great strides in training over the past several years, some key deficiencies remain. The most glaring is the limited joint training the PLAAF conducts, and this is covered in more detail in the next section on joint operations. Beyond limitations in joint training, tactical training continues to lag the best Western militaries. PLAAF tactical thinking appears to emphasize electronic warfare and scripted (and relatively basic) air combat methods over developing pilots who maximize the capabilities of their weapons systems. For example, we judge most PLAAF training events remain heavily scripted, with little autonomy save for an elite cadre of pilots. These events likely fall short of preparing the pilots for the tactical realities of modern air combat. To their credit, PLAAF leadership has identified this deficiency and the PLAAF appears to be addressing it. One outcome of this shift in thinking has been the creation of the Golden Helmet Air Competitions, which pit fighter pilots against each other in a reportedly free-play format that rewards cutting-edge skills and innovation. Events like these are likely to result in improvements in PLAAF tactical training over the coming years. Most significant, however, has been the PLAAF efforts at training with other countries’ air forces. Since 2010, the PLAAF has deployed 4<sup>th</sup> generation fighters to exercises with Turkey and Pakistan. While rudimentary in nature and scope, the PLAAF will continue to expand on these events as a way to access more advanced training concepts.

### **Second Artillery Corps**

In many ways, the training burdens on Second Artillery soldiers are somewhat less than their PLAAF counterparts. One key dependency inherent to missile warfare is targeting: effective and timely target selection is an absolutely critical part of the kill chain. We have little insight into this key phase, but it is quite possible that, as with overall joint integration, it may represent an overall structural weakness, and training at the unit level may not help address it.

Conversely, we do believe that Second Artillery assets routinely conduct realistic drills to practice the other key elements of operations, namely setting up and tearing down equipment, executing road marches,

and solving logistical challenges. In many ways, Second Artillery training is preparing its forces for the very tasks they will face in warfare.

**To what degree are the PLA Air Force and the Second Artillery Corps successfully recruiting and retaining high-quality personnel?**

Over the past two decades, China's rapid urbanization and development from an agrarian economy to a manufacturing center has limited the PLA's ability to recruit and retain highly-skilled members. In particular, the PLA continues to struggle developing and retaining quality aircrew, with numerous reforms of the pilot training process currently ongoing to ensure and control the quality of pilot trainees. Additionally, selection processes for some engineering positions in the Second Artillery continue to be highly competitive, though most sources indicate a dearth of highly-skilled technical personnel across all levels of the Chinese military. Adjustments to urban recruitment quotas, shortened conscription durations, a new Non-commissioned officer (NCO) corps, and the 2013 implementation of a summer conscription cycle all serve to decrease interference with semester-based school schedules needed to facilitate recruitment of increasingly technologically skilled personnel.

**How capable are the PLA Air Force and the Second Artillery Corps of operating jointly with other services?**

Over the past several years the PLA has made significant advances in establishing joint architecture and investigating joint processes. The PLA has developed and fielded a robust and increasingly modern C4ISR architecture, and this modernization has allowed for more joint execution. In order to cultivate their joint processes and command flows, the PLA has conducted several large-scale training events aimed at working out the best joint practices. The best example of this was the Lianhe (Joint Operations) series of exercises conducted from 2008-2010 that featured rotating leadership across the three armed services (PLA, PLAAF, PLAN) for each year's event.

Increasingly, the PLAAF has emphasized the planning and execution of joint fires execution of joint operations. The shift toward joint operations accelerated in the early 2000s when PLAAF officers began to assume key joint billets, including membership on the Chinese Communist Party's (CCP's) Central Military Commission (CMC) and other key positions within the PLA General Departments. Specific to PLAAF and Second Artillery training, the Chinese press has described several joint firepower exercises involving the two services over the past several years. For instance, in the summer of 2009 the PLAAF and Second Artillery conducted one of the first large-scale joint live-fire exercises involving elements from four missile brigades and two PLAAF air divisions.

Given the advancements in command-and-control infrastructure and the emphasis on joint training events, we judge the PLAAF and Second Artillery have attained a moderate level of capability to conduct pre-planned joint fires against fixed targets in the Pacific Theater. Joint firepower planning is accomplished by a Firepower Coordination Center that coordinates the air and theater missile campaign against key targets in order to achieve strategic and theater objectives. Firepower cells would contain PLA Air Force, Second Artillery, special operations, and ground and navy force elements that would carry out necessary liaison with their respective services. Beyond pre-planned strikes, attempts at conducting structured attacks between the Second Artillery and other services against fleeting or "pop-up" targets of opportunity would likely cause considerable difficulties, except in certain tactical situations.

Beyond joint fires conducted between the PLAAF and Second Artillery, we judge that true joint interoperability remains largely a work in progress for the PLA. Multi-service operations involving the PLAAF and Second Artillery with the other services are likely to be characterized by deconflicted operations, as opposed to being tactically integrated. For example, operations involving the PLAAF and

PLAN would likely consist of the PLAAF providing coincident air cover for PLAN units, and their actions would be deconflicted with naval aviation by location and timing. Jointness will largely be executed via well-deconflicted, time-phased operations of high precision; however, due to a lack of practiced interoperability, their efficiency will decline as they have to react to a dynamic environment and rapidly changing battlespace conditions. Recent exercises, such as Mission Action 2013, indicate the PLA continues to work on developing joint commanders and establishing joint procedures, and that they have not fully promulgated and implemented joint operational constructs such that they would be confident using them in wartime.